Success at Veterinary School

Success at Veterinary School: Evaluating the Influence of Intake Variables on Year 1 Examination Performance

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Abstract

A major challenge in admissions to veterinary medical degrees is to select those students with most suitability for clinical training programmes and careers from a large pool of applicants with very high academic ability. Predicting the success of students in a veterinary course is challenging and relatively few objective studies have been undertaken to identify factors that will facilitate progression through this educational experience. Prior educational attainment is considered by some to be a good predictor of success at undergraduate level.

The aims of study were to analyse intake data such as educational history and demographic factors of students entering the University of Edinburgh and to investigate possible relationships between these data and academic performance in the first year at veterinary school.

Data were collated for three veterinary intakes including school qualification, subjects, grades, Grade Point Average (GPA), degree classification, domicile, gender and age. Performance was measured by marks achieved in first year veterinary degree examinations. Relationships between marks and the influence of intake variables were statistically analysed via analysis of variance. For school-leaving entrants, the presence of straight As in school was linked to a better exam performance. Students with an A in Chemistry or Biology performed better; Mathematics and Physics did not show a consistent linkage with performance. Higher GPA was associated with better performance in first year for students on a graduate entry programme.

This study shows that prior educational attainment does appear to be linked with subsequent performance in the first year at veterinary school.

Key words: veterinary admissions, predictors of success, undergraduate selection, student performance

Introduction

Predicting the success of students in an undergraduate clinical veterinary course is challenging and relatively few objective studies have been undertaken to identify factors that will facilitate progression through this educational experience. There are two main ways of assessing the success of student selection procedures into professional clinical degree programmes: ability to complete the undergraduate course and success and competence in a subsequent career (e.g. how "good" a vet or doctor you become). Most studies on success and selection in medicine focus on performance in medical school rather than how "good" a doctor you become; indeed more work is needed to determine further the link between performance at medical school and subsequent success in the postgraduate domain.[1] In reality, students in courses such as veterinary medicine should be selected both for their ability to succeed in the course and also in their future profession[2]; ideally the two aspects should be aligned. According to the Schwartz Report in the UK on Fair Admissions to Higher Education, identifying "latent talent and potential which may not fully be demonstrated by examination results" is a legitimate aim in selection processes.[3] Equally, according to that report, prior educational attainment data remain the best indicators of success at undergraduate level and accordingly, evaluation of academic history remains central to the admissions process.

Previous academic performance (e.g. high school A-Level [AL] results) is considered by some to be the best predictor of the outcome at medical school.[4] Research from the USA has shown that in the veterinary course, academic difficulty experienced by veterinary students was associated with a low pre-requisite Grade Point Average (GPA) achieved prior to admission.[5] Kogan et al.[6] also showed that a higher incoming GPA was linked with better performance on course. In a study from South Africa, previous academic performance was positively correlated with academic performance at veterinary school.[7] One of the earliest studies in the veterinary setting in the UK found a correlation between entrance grades and performance in veterinary school.[8] A veterinary study from Austria showed that previous school performance was the best predictor of performance in first year examinations for the Austrian (but not German) cohort of students.[9] A further study from the same group in Austria has shown that the move to a selective admissions process (including evaluation of previous school performance) from a non-selective process was correlated with success in first year veterinary examinations.[10] More recently, again in a study from the USA, Molgaard et al.[11] showed that previous academic performance such as undergraduate GPA was predictive of performance at veterinary school. GPA was also found to be predictive of performance in the first two (preclinical) years at a US veterinary school.[12]

In terms of the best pre-requisite subjects to facilitate veterinary undergraduate training, there is limited objective published information. Muzyamba et al.[13] in a study in the UK, found that A-Level results in Chemistry, Biology and a third subject were predictive of performance in the early years of the veterinary course. In contrast, workers in the USA did not find any significant correlation between pre-veterinary course parameters and the class rank of third year veterinary students.[6] In the medical arena, a correlation has been demonstrated between performance in the medical course and performance in A-Level Chemistry and Biology[14-17] but interestingly, not Maths or Physics.[14]

However, there are contrasting reports both in medicine and veterinary medicine in terms of the impact of a variety of demographic factors such as age and gender on the performance of students on these clinical courses.[5,18,19,20]

The aim of this study was to analyse intake data such as educational history and demographic factors of students entering a traditional 5 year veterinary degree programme (5 year) and a 4 year accelerated graduate entry programme (4 year) at the University of

154 Edinburgh. Possible relationships between these data and academic performance in the
155 first year at veterinary school were investigated.

Materials and Methods

Data Collection and analysis

At the University of Edinburgh, there are two veterinary degree programmes: a traditional 5 year programme (5 year) and a 4 year accelerated graduate entry programme for graduates holding an appropriate biological or animal science degree (4 year). The majority of entrants to the 5 year programme come from high school with their school qualifications being assessed for entry; this is the usual pathway into veterinary medicine in the UK, unlike North America where graduate entry is more common. However, in recent years graduate entry is becoming increasingly common in the UK. School-leaving applicants from the UK (excluding Scotland), and some international students, usually apply presenting with the school qualification known as A-Level. For the entrants in this study, the A-Levels were those presented and graded according to a five-point scale (A, B, C, D, E) from examinations sat at around 17 to 18 years of age. The minimum requirements for entry into the University of Edinburgh veterinary degree programme for the non-graduate cohorts studied were AAB at General Certificate of Education (GCE) A-Level, meaning three A-Levels with awarded grades A, A and B. In Scotland, school-leaving applicants apply presenting with the school qualifications known as Highers and Advanced Highers which are usually sat in the last two years of high school by pupils aged around 16 to 18 years of age. Highers and Advanced Highers are graded according to a four-point scale (A, B, C, D). For Scottish-domiciled applicants, the minimum requirements were AAABB at Scottish Qualifications Authority (SQA) Higher Level and BB at Advanced Higher Level; this means five Highers with awarded grades A, A, A, B, B and two Advanced Highers with awarded grades B and B. UK undergraduate degrees can be classified as first class with a final mark ≥ 70% or upper second class with a final mark of 60-69%; there are also further classifications below these marks. For graduate applicants, the preferred requirements were a minimum of an upper second class degree (2i), or a minimum grade point average (GPA) of 3.4 (on a four point scale). Data encompassing entrant background information were collected and collated for three consecutive annual intakes (2007, 2008 and 2009).

Data on entrants from high school included: school qualification (e.g. A-Level, Highers, Advanced Highers), subjects taken including grades, school type (state or independent), whether a gap year was taken, gender and age (<21 years or not). It was recorded whether the A-Levels were obtained in the UK or not. Particular additional data collected for graduate entrants included degree classification (UK 1st or 2i), whether the degree was from the UK, rest of the European Union (rEU) or elsewhere in the world (RoW), student domiciled in the rEU or North America prior to starting BVM&S course, grade point average (GPA on a 4.0 point scale) and years elapsed between award of degree and starting veterinary school. Therefore, RoW applicants would include some students from North America presenting with an undergraduate degree. Entrants were divided into whether they were entering the 5- or 4-year BVM&S course and, within that, they were initially subdivided into four 5-year groups (UK/rEU Scottish Funding Council-funded [SFC] school leavers, RoW school leavers, UK/rEU graduates and RoW graduates) and two 4-year groups (UK/rEU graduates, RoW graduates). Any A-Level or Advanced Higher results from graduate entrants were ignored (not factored into the analysis) as the research focus was the highest (or most recent) qualification evaluated as part of the admissions process for entry to the veterinary school.

The calibre of an entrant's academic institution as profiled by reference sources (Barron's Profiles of American Colleges[21] and University league tables) was also determined (bands A to C, see below). Universities in the UK and rEU were ranked by using the Top European Universities guide (2008 rankings[22]).The overall scores in the Top European Universities in this guide ranged from 98.9% - 33.8%. The percentage rankings were

classified into 3 equal bands within these parameters (A, B and C, universities in descending order of score band). Where UK and rEU universities did not appear in the above European rankings, a combination of the world University rankings[22] and the Times Good University Guide[23] was used to establish a relevant ranking. These Universities were below the lowest score published on the Top European Universities and hence they were subsequently all ranked as band C. If the institution was not in either guide, a rank of C was ascribed.

The Barron's Profiles of American Colleges, 27th Edition[21] was used to rank USA Universities and Colleges. This profiling resource ranks institutions according to admissions competitiveness. These institutions were then separated into bands A, B and C using the following method: A (corresponding to Barron's classification of 'Most Competitive'; 'Highly Competitive'), B ('Very Competitive') and C ('Less Competitive', 'Competitive+', 'Competitive'). There were some instances whereby two categories were ascribed for a student, for example, 'Competitive' and 'Most Competitive'" as the student had studied at two institutions in order to obtain a degree qualification but would only graduate from one. In these cases, the institution where the student had been awarded the degree qualification was used. The rankings of Canadian universities were firstly taken from the world rankings.[22] Next, each Canadian university was compared with the nearest ranked USA university and then assigned the ranking of A, B or C from this comparison.

The student cohorts were tracked and the results of the examinations for their first year at veterinary school were collected. Performance was measured by the marks achieved in first year degree examinations. Only the results from the student's first attempt of the particular examination diet were used for analysis; i.e. re-sit results were not used. These marks were the average percentage for the whole year (0-100%) weighted by the number of credits that courses within the year had accredited to them. Because of the heterogeneity of subjects studied in individual years and differing teaching and assessments between 4 year and 5 year degree programmes, the exam results were calculated as an average percentage for the whole year. In the first year (of both the 5 year and 4 year programmes) at Edinburgh, subjects covered include studies of the animal body (incorporating anatomy, physiology, cell biology, biochemistry, introductory pathology, animal health and welfare).

The relationships between marks and the influence of intake variables were statistically analysed using analyses of variance. Normality of residuals was confirmed prior to reporting of analyses. For all analyses, the cohort that the student formed part of was initially added into the statistical model as a first fixed effect. Other explanatory variables were then added to the model. For analysis of grades in examinations undertaken prior to entry into the vet school, the type of grade - Scottish Advanced Higher, Scottish Higher, A-Level and GPA, and the University A-C rank described above - were considered separately. There were not enough students (9) that started the five year programme that had graduated from a non UK/rEU university for them to be considered as a separate group to UK/rEU graduates and so these two groups were combined for the analyses. Analysis of variation in marks and pass rates in the three 5-year groups (UK/rEU SFC school leavers, RoW school leavers, UK/rEU/RoW graduates) and the two 4-year groups (UK/rEU graduates and RoW graduates) were considered separately as the 2 programmes differed markedly in teaching material. All analysis was carried out in R (V3.3.1 © The R Foundation for Statistical Computing), and $P<0.05$ was taken to indicate statistical significance.

This Admissions research study was approved by the College of Medicine and Veterinary Medicine Ethics Committee at the University of Edinburgh.

Results

The three entrant cohorts totalling 448 students consisted of 130 students in 2007 (93 in 5 year programme and 37 in 4 year), 147 in 2008 (98 in 5 year and 49 in 4 year) and 171 in 2009 (105 in 5 year and 66 in 4 year). The attributes of these students are summarised in Table 1.

(Place Table 1 here)

Fourteen of the entrants (3.0% : 7 UK/rEU SFC-funded school leavers, 2 graduates on the 5 year programme, 5 graduates on the 4 year accelerated programme) withdrew before the end of their respective first year, precluding any analysis of the end of year mark for these entrants, leaving 434 students with end of year examination marks. As only 3% of the entrants withdrew before the end of the year, the statistical power associated with any analysis of whether withdrawal was dependent on any of the variables was likely to be low, and therefore the lack of statistical significance for any variable was not surprising ($P>0.125$). Over 90% of entrants (93.1%, 404 of 434) passed (≥50% for average Year 1 mark) their first year at the first attempt, again limiting the power likely to be associated with any analysis.

End of Year 1 examination mark

The end of Year 1 performance marks are summarised in Tables 2a and 2b. There was a statistically significant difference between the 5 year overall end of year 1 mark (64%) compared to the 4 year mark (60%, $P<0.001$, Table 2a). The average end of year 1 examination marks did not statistically significantly differ between either the three 5 year groups of entrants (63-64%, $P=0.879$; or the two 4 year groups of entrants (60%, $P=0.975$, Table 2a). In addition, there was no statistically significant difference between cohorts in either the 5 year or 4 year programmes ($P>0.052$, Figure 1a), nor was there any statistically significant interaction between cohort and either the three 5 year groups of entrants ($P=0.891$) or the two 4 year groups of entrants ($P=0.763$, Figure 1b).

(Place Table 2a here)

For school-leaving entrants to veterinary school, the presence of straight As in school subjects (A-Level [AL], Advanced Higher [AH] and Higher) was linked to statistically significantly better exam performance in end of first year examinations compared to students with grades less than A ($P<0.001$; AL: 67% vs 60%, AH: 67% vs 59%, Higher: 64% vs 57%; Table 2a, Figure 2a). However, this was not dependent on whether UK AL were taken or not ($P=0.055$, Table 2a).

While there was no statistically significant cohort-dependent effect with the A Level results ($P=0.205$), there was a significant cohort effect with whether school-leaving entrants achieved all grade A in their AH ($P=0.023$, Figure 2a) : there was no statistically significant difference in the end of year mark in the Entry Cohort 2 (2008) with whether the school-leaving entrants achieved all As in their AH ($P=0.318$, All A:61%, Not all A:59%), but the statistically significant difference remained for Entry Cohorts 1 and 3 (2007 – All A: 73%, Not all A: 60% - and 2009 - All A: 69%, Not all A: 58%% -, Figure 2a, $P<0.003$).

If just whether school-leaving entrants had obtained an A in Biology was considered, again there were statistically significant differences ($P<0.001$; AL: A 67% vs <A 50%, AH: A 65% vs <A 58%, H: A 63% vs <A 49%; Table 2a, Figure 2b), and again this was not entry cohort dependent ($P>0.477$), nor was the AL difference UK/non-UK dependent ($P=0.881$). In addition, school-leaving entrants gaining an A in AH Chemistry had statistically significantly higher end of first year examination marks ($P<0.001$, 65% vs < A 57%, Figure

2c, Table 2a), with too few school-leaving entrants (N=4) obtaining less than an A in AL Chemistry to facilitate analysis. The reason for this is that, in the main, candidates with less than A in AL chemistry are not admitted due to the entrance requirements. In contrast, no statistically significant differences in end of first year examination marks were observed depending on whether school-leaving entrants had obtained an A or not in either Mathematics (at AL or AH) or Physics (at AL, AH or H) (P>0.090, Table 2a).

As mentioned above, for those Scottish-educated students that would have also taken Highers, as with the Advanced Highers, there was statistically significantly better exam performance in end of first year examinations with straight As compared to students with grades less than A (P<0.001; 64% vs 57%, Table 2a, Figure 2a), and this was not entry cohort dependent (P=0.895). In addition, this statistically significant effect remained if just whether a grade A Higher was obtained in Biology (P<0.001; A 63% vs < A 49%, Table 2a, Figure 2b) and Mathematics (P=0.038; A 63% vs < A 58%, Table 2a, Figure 2d), but no statistically significant differences were observed with Physics (P=0.116; A 63% vs < A 57%) and Chemistry (P=0.359; 62% vs 57%; Table 2a). Again, very few candidates are accepted with < A in Higher Chemistry as this is a minimum entry requirement.

There was some evidence of differences in year 1 performance if school-leaving entrants from the UK had been to an independent (66%) or state school (63%, P=0.028, Table 2a), though the impact was not large (Figure 3a). However, there was a statistically significant interaction between school type and whether a grade A had been obtained in an AH Biology (P=0.001), with a greater difference in exam performance between those Scottish school-leaving entrants that attended an independent school (A: 68%, <A: 48%) compared to a state school (A: 64%, <A: 60%, Table 2a, Figure 3b). This statistically significant difference was not reflected in the differences in average marks between those school-leaving entrants that had or had not achieved either all As in Highers or A in a particular Higher subject (P>0.112).

Only two of the 21 graduates on the 5 year programme obtained a UK 1st class degree, precluding any statistical analysis of a 1st compared to a 2i. For the 4 year programme, there was no statistically significant improvement in exam performance of graduates with a 1st compared to a 2i (P=0.057, Table 2b). In addition, in graduate entrants from outside the UK on the 5 year programme there was no improved exam performance in those with a higher GPA (≥3.4) (P=0.964, Table 2b). In contrast, in graduate entrants from outside the UK on the 4 year programme there was a statistically significantly improved exam performance in those with a higher GPA (≥3.4) compared to those with a GPA < 3.4 (62 vs 56%, P=0.015, Table 2b, Figure 4). For all entrants, increased age ($\geq$21 years of age) at the onset of veterinary studies was associated with a statistically significantly reduced exam performance (P=0.003, $\geq$21: 61%, <21: 64%, Table 2b). However, this is confounded by whether entrants have done a degree or not, as no entrants with a previous degree were <21, and only 2% of school entrants were $\geq$21. If entrants were sub-divided into whether a school leaver or with a previous degree, then there was no statistically significant relationship between actual age and exam performance in either group (P>0.262).

(Place Table 2b here)

No statistically significant association with exam performance was found for any of the other variables (gender, domicile, whether a gap year was taken, time elapsed since previous study, where degree was obtained or university grade) in both the 4- and 5-year programmes (P>0.131, Table 2b).

Discussion

This study showed that some intake variables, primarily previous academic history, were associated with subsequent academic success or otherwise in the first year at veterinary school. In the veterinary setting, most studies show a link between prior attainment and performance in the early years[9,11,12] with fewer showing a link with performance in later or final years.[7]

This study encompassed three entry cohorts (2007, 2008 and 2009); this had the benefit of generating a large sample size for analysis and allowed the identification of any particular cohort effects. Although there were occasional cohort effects, these were not common and it was still possible to draw conclusions about the impact of intake variables independent of particular cohort effects. It is important to note that the analysis of veterinary school results for the students was on the basis of their first attempt at the exams, rather than re-sits; it was considered that this was the best way of comparing students with their peers in relation to their intake variables and when sitting the same schedule of exams. In each diet of exams, there is a small number of students who sit the exams with special circumstances (e.g. ill health) and they are allowed to then sit the exam at a later re-sit diet, but have this subsequent attempt viewed as a first attempt. Also, there is a small number of students who move between cohorts e.g. if they dropped down a year due to intercalating studies or having to repeat a year; it was not possible to track these students in this study. Therefore, it was considered that the small number of students who fell into this category would not impact the statistical evaluation of the large dataset of the first attempt results of the entire year cohorts. This small group of students could potentially be looked at in future studies, but it would be difficult to draw conclusions owing to the small numbers involved.

Students (school-leaving entrants) that had straight As in high school subjects achieved better exam performance in the first year at veterinary school. When evaluating the impact of school subjects studied, it was found that Biology and Chemistry had more effect on subsequent performance than Maths and Physics. This is largely in agreement with the findings in veterinary medicine[13] and medicine[14,15,17] where prior attainment in Chemistry and Biology is linked with performance on course. An exception to this trend was the finding from an Italian veterinary study where the performance in the Biology section of an admissions test was not linked with performance on course; accordingly the Biology requirement in the test was removed.[24] Furthermore, Muzyamba et al.[13] found that performance in the third A-Level subject (in addition to Chemistry and Biology) was linked with performance in the early years at vet school and Montague and Odds[14] found that A-Level Maths and Physics grades had no correlation with performance at medical school. In this current Edinburgh study, an A in Biology at AL, AH and H was linked with better exam performance; similarly, an A in AH Chemistry was associated with better exam performance. It was unsurprising that an effect of AL and H Chemistry on subsequent performance was not observed; this is because at the time of entry an A in these qualifications was a minimum entry requirement, so that there were too few students entering the course with < A to permit statistical analysis. Interestingly, although the effect of Maths was not as strong as Chemistry and Biology, an A in H Maths was associated with better performance in Year 1.

There was a small effect of the type of school attended (state vs independent) on exam performance, with students who attended an independent school doing slightly better. For Scottish-educated students, this effect appeared to be counter-balanced by a greater drop off in performance in students who achieved < A in AH Biology from an independent school compared to students from a state school. There are limited reports detailing the impact of school type on performance in veterinary medicine and medicine. Muzyamba et al.[13] reported that students from independent school were more likely to pass final year in

a UK veterinary degree. Lumb and Vail[18] found that school type had no effect on performance in the third year of medical school. In contrast, in a study at the University of Edinburgh across a broad range of subjects from humanities to sciences, students from independent schools did not achieve as good outcomes in their degrees as peers from state schools.[25]

For graduate entrants to the 4-year programme, prior educational attainment such as GPA ≥ 3.4 was linked with better exam performance. The apparent effect of increased age negatively impacting exam performance was likely due to the confounding effect of being a graduate. The literature regarding the impact of age on performance is conflicting with some studies showing that, in the veterinary setting, increased age (≥35 years) was linked with academic difficulty[5] and that, in a medical study, older students were more likely to have difficulty passing the final degree.[15] However other studies in the medical setting reported that age had no impact on performance[18] or knowledge acquisition.[20]

Furthermore, although on face value it would appear that the 5-year students performed better in first year when compared to the 4-year students, this comparison is not really realistic. The respective two courses that these students are taking are completely different, both in terms of delivery and assessment; accordingly one is not comparing 'like with like'.

There was no effect of any of the other variables on performance in the first year at veterinary school for either the 5-year or 4-year programmes; these variables were gender, domicile, whether a gap year was taken, time elapsed since previous study, where degree obtained and university grade. A potential limitation of this study is the difficulty in characterizing and ranking the wide range of educational and personal background experiences of the candidates applying to our veterinary school. However, the groupings and characterization of the candidates as detailed above (including GPA preferred minimum entry thresholds, Barron's Profiles of American Colleges and university league tables etc.) made some attempt to evaluate the 'heterogeneous' nature of the veterinary school applicants, including their educational histories.

Therefore it can be seen that prior educational attainment does appear to be correlated with performance in the first year at veterinary school. Biology and Chemistry appear to have the greatest impact, with Biology having slightly more of an effect than Chemistry. These subjects have more of an effect than Maths and Physics; this perhaps has implications on the existing perceptions regarding the entry criteria (both in terms of required subjects and grades) that a particular institution sets for entry onto the veterinary course. For instance, at Edinburgh, insisting on an A in Chemistry (at AL and H) as an entry requirement for entry was in place at the time of these study cohorts rather than insisting on the same for Biology, which is now the case. In addition, at the time of the study cohorts, the preferred requirements for AL were Chemistry, Biology and one of Physics/Maths. The results of this study suggest that pre-requisites might be changed without negatively impacting performance in the first year at veterinary school. The results of the intake studies provided an evidence base to help inform the University of Edinburgh's Veterinary Admissions Committee's decision to change the subject entrance requirements and the number of A grades required (since 'all As' was linked with better performance). Subsequent to these cohorts, admissions requirements have been changed to AAA at AL and AAAAB in Highers (with A in both Chemistry and Biology, rather than just Chemistry); Also the requirement for the third subject at A-Level to be Maths or Physics has been removed, in favour of a third approved subject (from a large list of subjects); this adds flexibility to an applicant's subject choices and also may add to the breadth of educational experience that students have before university.

All veterinary schools are always trying to refine and improve their admissions process in the knowledge that a successful admissions process will ultimately lead to a better

teaching and student experience on course, and hopefully on into postgraduate life. It is clear that admissions research with linkage into the teaching continuum is needed; this will help future evidence-based development of admissions processes. Furthermore, identification of patterns and predictors for success on our course will allow institutions to identify ‘at risk’ students and tailor our teaching programme and associated support mechanisms accordingly.

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Figure Captions

Figure 1: Violin density plots of average marks in Year 1 of the BVM&S for students in 3 entry cohorts (2007, 2008 and 2009: EC 1-3) that completed their first year and had started (a) either the 5- year or 4- year accelerated graduate entry programme; (b) had started the 5- year programme as a school-leaver, either UK/rest of EU (rEU) Scottish Funding Council-funded (SFC) or rest of the world (RoW)); or had graduated either from a UK, rest of the EU or rest of the world university (UK/rEU/RoW); or had started the 4- year accelerated programme either as a UK/rEU graduate or a graduate from the rest of the world (RoW). Average marks (%) for the whole year were weighted by number of credits attached to courses within the Year 1. The width of each violin plot at any one value reflects the frequency of that mark in that group. Boxes within the violins represent the interquartile range, and the round symbols the medians. Numbers in brackets are number of students in a particular group. *** $P<0.001$.

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Figure 3: Violin density plots of average marks in Year 1 of the BVM&S for students in 3 entry cohorts (2007, 2008 and 2009: 1-3) in relation to whether the students had (a) attended an independent or state school and (b) attended an independent or state school and achieved a Grade A or less in Advanced Higher Biology. The width of each violin plot at any one value reflects the frequency of that mark in that group. Boxes within the violins represent the interquartile range, and the round symbols the medians. Numbers in brackets are number of students in a particular group. *** $P<0.001$, * $P<0.05$.

Figure 4: Violin density plots of average marks in Year 1 of the 4- year accelerated BVM&S programme for students in 3 entry cohorts (2007, 2008 and 2009: 1-3) in relation to whether non-UK graduate students had obtained a grade point average (GPA) ≥ 3.4 or <3.4 in their previous degree. The width of each violin plot at any one value reflects the frequency of that mark in that group. Boxes within the violins represent the interquartile range, and the round symbols the medians. Numbers in brackets are number of students in a particular group. * $P<0.05$.

Tables

Table 1. Summary of attributes associated with students in the 3 cohorts entering the BVM&S Programme in 2007 (Cohort 1), 2008 (Cohort 2) and 2009 (Cohort 3)

	Entry Cohort 1	Entry Cohort 2	Entry Cohort 3
Five year programme entrants	93	98	105
UK/rEU School leavers	72	72	72
RoW School leavers	13	14	19
UK/rEU Graduates	6	9	8
RoW Graduates	2	3	6
Four year graduate entrants	37	49	66
UK/rEU Graduate	13	21	21
Overseas Graduate	24	28	45
Cohort Total	130	147	171
Gender : Female (%)	79.2	78.2	75.4
Age (years)			
Average ± SD	20.5 ± 3.7	21 ± 3.8	21.5 ± 3.9
≥ 21 (%)	35.4	42.9	49.1
School education			
A-Levels (Non-Scottish)	31	36	53
All A grade (%)	67.7	75.0	73.6
Biology A (%)	93.5	80.6	92.5
Chemistry A (%)	93.5	94.4	98.1
Mathematics A (%)	91.3	88.9	92.9
Physics A (%)	66.7	100.0	62.5
Advanced Highers (Scottish)	49	41	30
All A grade (%)	22.4	41.5	40.0
Biology A (%)	40.4	73.7	55.2
Chemistry A (%)	61.2	65.9	56.7
Mathematics A (%)	40.0	35.7	80.0
Physics A (%)	70.6	80.0	66.7
Highers (Scottish)	49	41	31
All A grade (%)	83.7	70.7	67.7
School type (UK students)			
State	57	50	53
Independent	13	22	19
Gap year between school and university (SFC-funded UK/rEU students)	7	8	15
Domicile (Graduates)			
UK / rEU	21	29	30
USA / Canada	24	33	50
Grade point average (Graduates)			
Average ± SD	3.59 ± 0.19	3.51 ± 0.20	3.47 ± 0.21
≥ 3.4 (%)	84.0	67.9	59.1
University Grade (Graduates)			
A	13	17	31
B	21	25	22
C	11	20	28
UK Degree qualification			
1st	6	5	3
2i	14	25	26

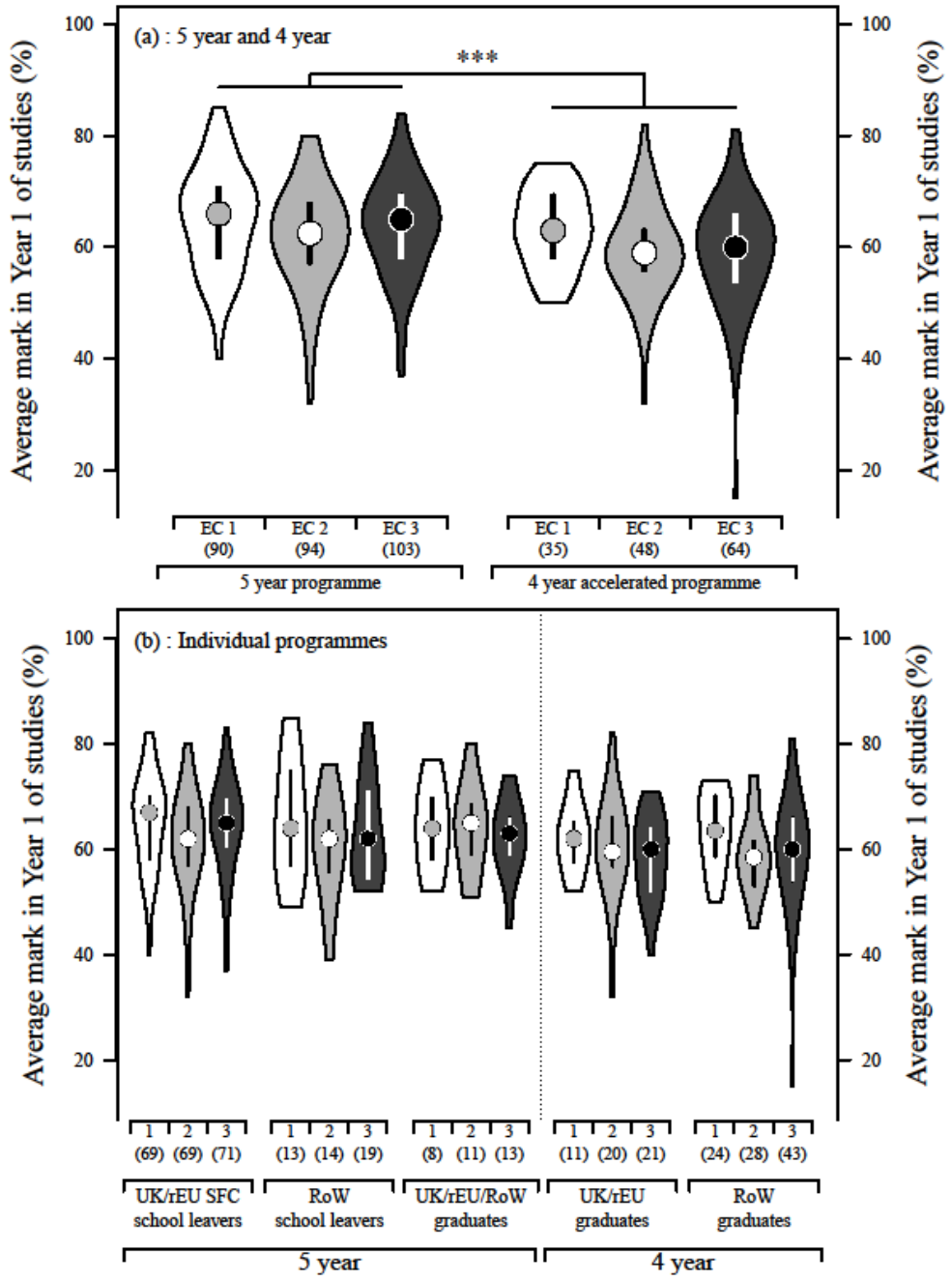
Table 2a : Summary of the end of BVM&S Year 1 performance mark (P value, average ± SD)

Variable	P value	Group	
Programme		5 Year	4 year
Overall	**<0.001**	63.5 ± 9.4	60.1 ± 9.1
UK/rEU SFC School leavers		63.7 ± 9.4	-
RoW School leavers	0.879	62.9 ± 10.3	-
UK/rEU/RoW Graduates		63.1 ± 7.9	-
UK/rEU Graduates	0.975	-	59.9 ± 8.7
RoW Graduates		-	60.1 ± 9.4
A-Levels (Non-Scottish)		Yes	No
All A grade	**<0.001**	66.8 ± 8.1	59.7 ± 11.7
UK	0.055	67.0 ± 7.1	61.9 ± 12.2
RoW		66.3 ± 10.8	53.0 ± 6.8
		A	< A
Biology A	**<0.001**	66.5 ± 8.0	50.3 ± 11.2
Chemistry A	0.622	64.9 ± 9.8	63.0 ± 5.2
Mathematics A	0.795	64.3 ± 10.2	65.0 ± 7.1
Physics A	0.409	66.3 ± 10.9	65.2 ± 8.6
Advanced Highers (Scottish)		Yes	No
All A grade	**<0.001**	66.9 ± 8.3	59.3 ± 8.8
		A	< A
Biology	**<0.001**	65.0 ± 8.3	58.1 ± 9.6
Chemistry	**<0.001**	64.7 ± 8.9	57.2 ± 8.2
Mathematics	0.091	67.1 ± 10.8	60.6 ± 8.8
Physics	0.847	62.3 ± 8.7	63.1 ± 4.6
Highers (Scottish)		Yes	No
All A grade	**<0.001**	63.7 ± 8.7	56.8 ± 9.2
		A	< A
Biology A	**<0.001**	62.8 ± 8.9	49.4 ± 6.6
Chemistry A	0.359	62.1 ± 9.4	57.0 ± 0.0
Mathematics A	**0.038**	62.8 ± 9.4	58.1 ± 9.0
Physics A	0.116	62.5 ± 9.7	57.3 ± 7.3
School type		Independent	State
Overall	**0.028**	65.8 ± 9.9	62.9 ± 9.2
Advanced Highers Biology : A	**0.001**	68.1 ± 9.0	64.3 ± 8.0
Advanced Highers Biology : < A		48.0 ± 9.5	59.6 ± 8.8
Highers : All A	0.113	66.1 ± 9.8	63.3 ± 8.5
Highers : At least 1 < A		53.0 ± 14.9	57.7 ± 7.4

Table 2b : Summary of the end of BVM&S Year 1 performance mark (P value, average ± SD)

Variable	P value	Group		
Degree mark (UK Graduates)		1st	2i	
5 year programme	-[a]	70.0 ± 2.8	62.0 ± 9.2	
4 year programme	0.057	65.5 ± 6.3	59.5 ± 8.7	
GPA (Non UK graduates)		≥ 3.4	< 3.4	
5 year programme	0.964	64.6 ± 8.0	62.8 ± 5.8	
4 year programme	**0.015**	62.1 ± 10.2	55.8 ± 6.3	
Gender		Female	Male	
5 year programme	0.348	63.8 ± 8.8	62.5 ± 10.9	
4 year programme	0.784	60.2 ± 9.4	59.5 ± 8.0	
Age at start of degree	**0.003**	<21 years 63.6 ± 9.5	≥21 years 60.6 ± 9.1	
Gap year taken (UK/rEU school)	0.760	Yes 63.2 ± 7.6	No 63.7 ± 9.7	
Domicile (Graduates)		UK/rEU	USA/Canada	
5 year programme	0.244	61.4 ± 7.9	64.4 ± 8.0	
4 year programme	0.551	60.7 ± 8.5	59.8 ± 9.6	
Where Degree obtained		UK	rEU/RoW	
5 year programme	0.132	61.1 ± 8.5	64.8 ± 7.5	
4 year programme	0.385	61.1 ± 8.4	59.5 ± 9.5	
University Grade		A	B	C
5 year programme	0.053	67.1 ± 4.8	59.9 ± 8.5	61.7 ± 8.5
4 year programme	0.842	60.5 ± 11.2	60.4 ± 7.9	59.0 ± 8.1

[a] Only 2 entrants on 5 year programme with a 1st



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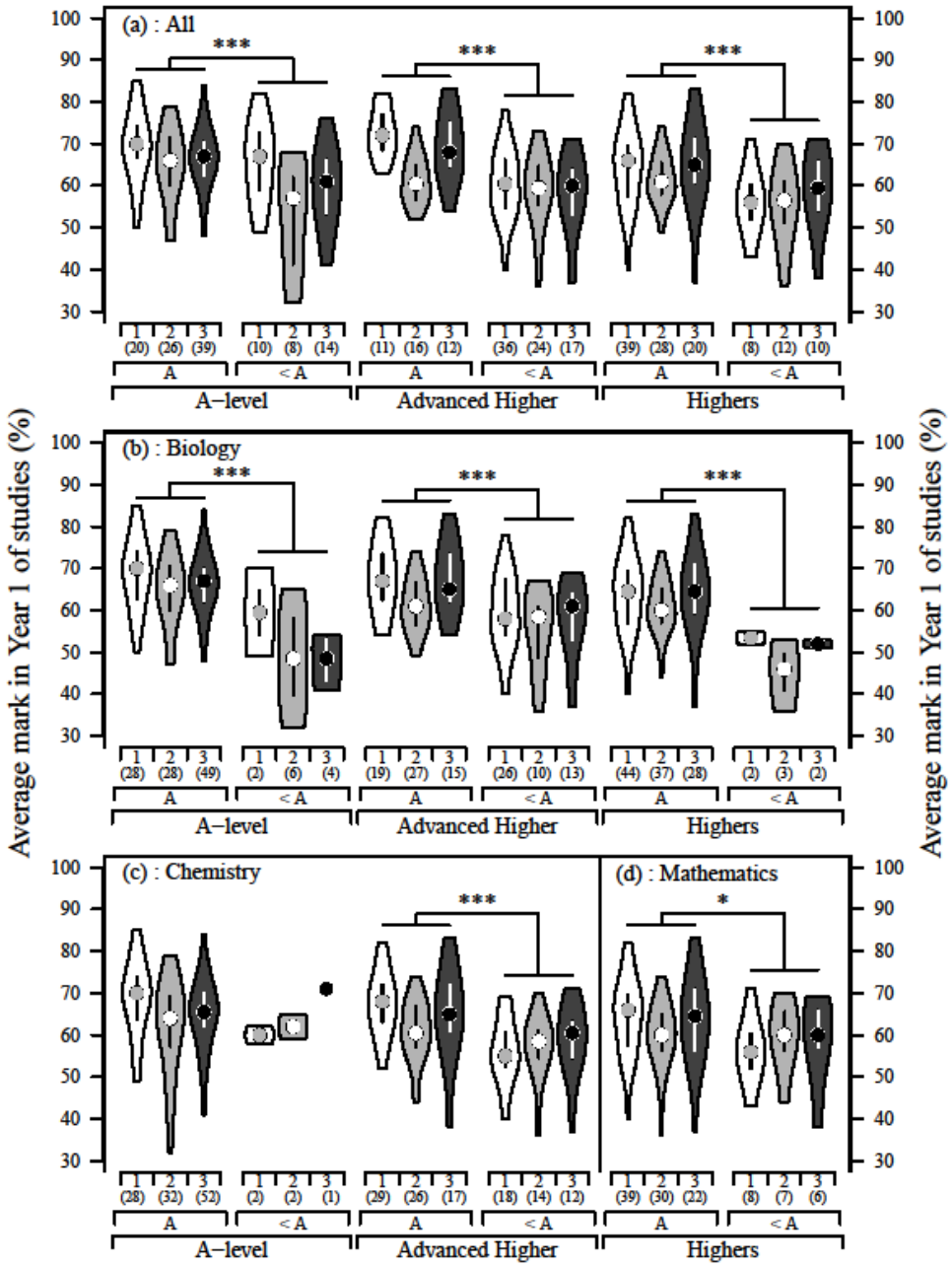

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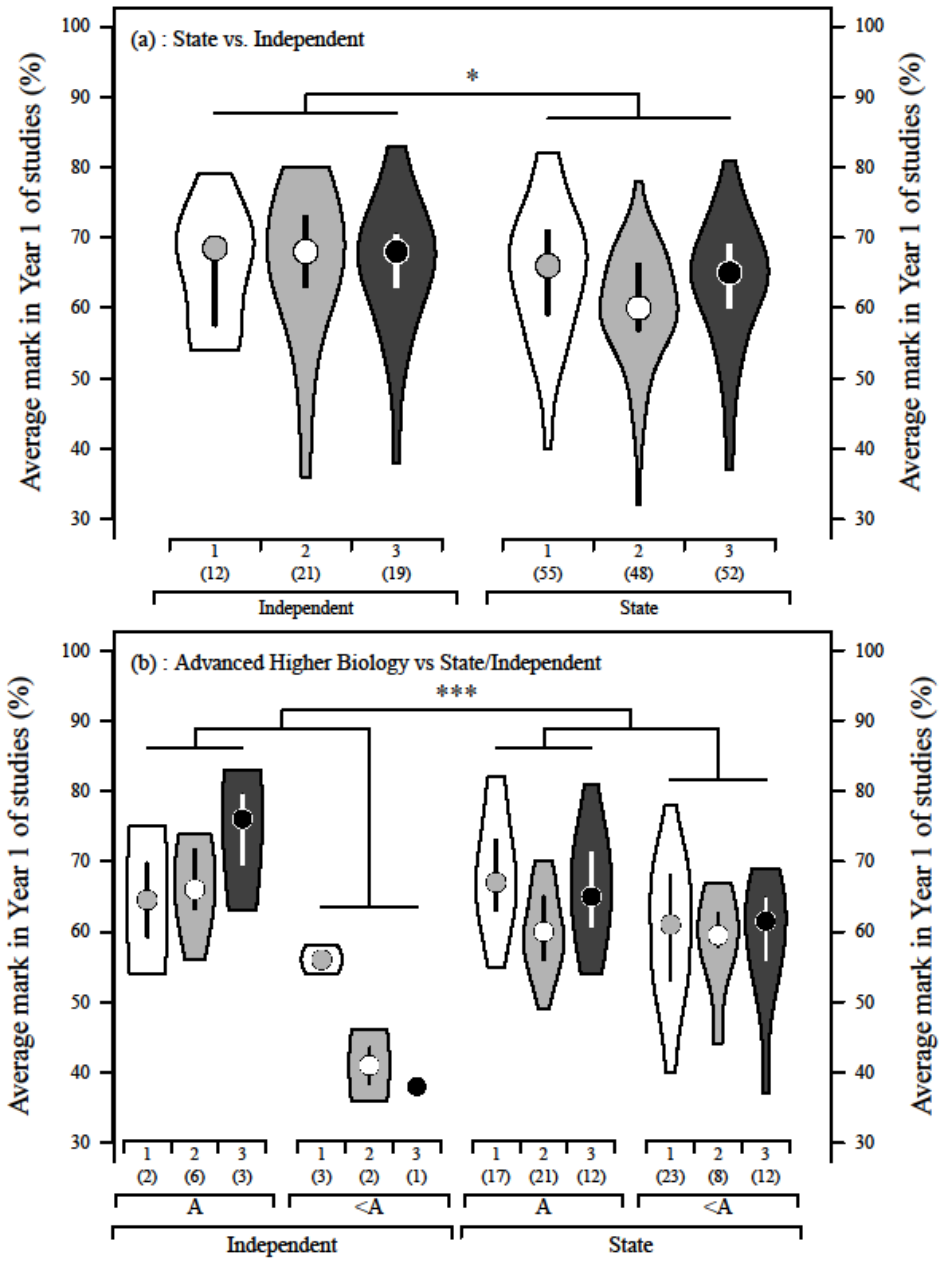

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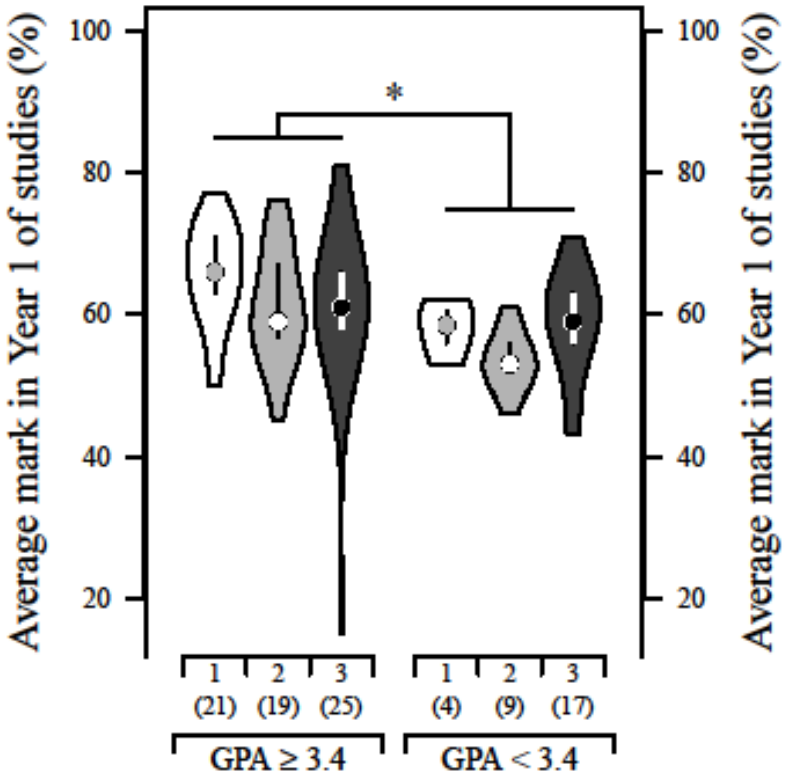

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